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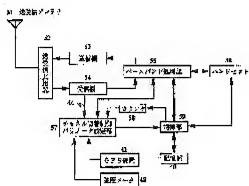
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(54) MOBILE COMMUNICATIONS CHANNEL CHANGEOVER SYSTEM AND MOBILE STATION EQUIPMENT

(57)Abstract:

PURPOSE: To optimize channel changeover by grasping information of an elapsed time from a reception level, a speed, a position and preceding channel allocation of a mobile station and revising a channel changeover control parameter in response to the information.

CONSTITUTION: When channel assigning is made, a control section 59 outputs a reset signal and a counter 58 of a mobile station counts the elapsed time. A channel changeover control parameter setting section 57 acquires mobile station state information such as a reception level, a mobile station speed, a mobile station position and the elapsed time from a receiver section 55, a speedometer 42, a GPS device 41 and the counter 58. The information of the reception level in a base station is sent from the base station and extracted from a base band processing section 55 via a receiver 54 and inputted to a setting section



57. The setting section 57 calculates an optimum parameter at a current point of time from the state information and sends the result to the control section 59 and stored in a storage section 40. Then the control is executed based on the stored information. Thus, optimum channel changeover control is executed.

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2. **** shows the word which can not be translated.

3. In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention is used for radio. This invention is suitable for using for a cell phone unit. It is related with the switchover control art in the communication area currently especially assigned for every base station.

[0002]

[Description of the Prior Art] Transmission power per [which constitutes the service area which consists of two or more base stations from a mobile communication system in order to correspond to the increase in a member] base station is made low, The communication area (henceforth a cell) which is the grasp is limited to the narrow range, a service area is subdivided, and the cellular communication system which repeats the same frequency geographically and uses it is used. In the cellular communication system, the radius of the cell is made small in order to raise frequency utilization efficiency, but channel switching is frequently performed with movement of a mobile station, so that the radius of a cell is small.

[0003] When channel switching becomes smaller than going up between a base station and a mobile station, and the reference value which got down and supervised the channel and with which communication quality was set up beforehand, Or when there is a high base station of communication quality from the base station under communication beyond in a certain reference value, it is carried out by securing the empty channel in the base station of a movement destination. in order that communication quality may lose "flustering" -- being certain -- fixed time equalization is carried out and it compares with a reference value.

[0004] The rate of forced release of the call at the time of the channel switching to the channel-switch-control parameter obtained by computer simulation and channel switching operation fluster, and the relation of the number of times, i.e., control load, is shown in Table 1. Table 1 is a table in which the rate of forced release of the call at the time of the channel switching to the channel-switch-control parameter obtained by computer simulation when movement speed was made into a second in 6 m /, and channel switching operation flustering, and showing the relation of the number of times, i.e., control load.

[0005]

[Table 1]

平均化時間	0.8 s	1.2 s	1.6 s
判定基準	2 dB	8 dB	16 dB
ばたつき回数	12.5	0.74	0.35
強制切断率	0.051	0.12	0.19

This relation is shown in [drawing 6](#). [Drawing 6](#) is a figure in which the rate of forced release of the call at the time of the channel switching to the channel-switch-control parameter obtained by computer simulation when movement speed was made into a second in 6 m /, and channel switching operation fluctuating, and showing the relation of the number of times, i.e., control load. As shown in [drawing 6](#), it fluctuates with the rate of forced release, and the number of times has a reverse proportion relation, a channel-switch-control parameter fluctuates with the rate of forced release, and an optimum value is determined by the intersection with the number of times. This channel-switch-control parameter is beforehand set as a fixed value by computer simulation, and is stored in the channel-switch-control circuit of a base station device and a mobile station.

[0006]

[Problem(s) to be Solved by the Invention] However, it fluctuates and the number of times and the rate of forced release change with the states of a mobile station. the movement speed of the mobile station obtained by computer simulation is received -- it fluctuates and the relation between the number of times and the rate of forced release is shown in Table 2. Table 2 is a table to the movement speed of the mobile station obtained by computer simulation when it was considered as a judging standard of 8 dB for averaging time 1.2 seconds in which fluctuating and showing the relation between the number of times and the rate of forced release.

[0007]

[Table 2]

移動速度	1 m / s	5 m / s	10 m / s
ばたつき回数	22.0	1.82	0.36
強制切断率	0.014	0.031	0.28

This relation is shown in [drawing 7](#). [Drawing 7](#) is a figure to the movement speed of the mobile station obtained by computer simulation when it was considered as a judging standard of 8 dB for averaging time 1.2 seconds in which fluctuating and showing the relation between the number of times and the rate of forced release. As shown in [drawing 7](#), the mobile station with slow movement speed fluctuates, the number of times becomes large, and, as for the mobile station with quick movement speed, the rate of forced release becomes large. the receiving level of the mobile station obtained by computer simulation and a base station is received -- it fluctuates and the relation between the number of times and the rate of forced release is shown in [drawing 8](#). [Drawing 8](#) is the mobile station obtained by computer simulation, and a figure to the receiving level of a base station in

which fluctuates and showing the relation between the number of times and the rate of forced release.

[0008]It fluctuates according to the state of a mobile station, and the number of times and the rate of forced release change so that clearly from drawing 6 - drawing 8. Therefore, using a uniform channel-switch-control parameter to all the mobile stations with which states differ becomes a factor which brings about the increase in the rate of forced release, and increase of control load depending on the state of the mobile station, and the quality of channel switching deteriorates.

[0009]This invention is carried out to such a background and is a thing.

The purpose is to provide the mobile communications channel switching method which can carry out the setting variation of the channel-switch-control parameter to the optimal value at any time according to a state.

[0010]

[Means for Solving the Problem]The first viewpoint of this invention via a wireless circuit to two or more base stations and this base station Many connectable mobile stations, A means by which it has an exchange station which controls said two or more base stations, and said base station detects a communicating state and a movement state of said mobile station which exist in a self-cell. When it has a means to perform channel switching according to a detection result of this means to detect and said mobile station deviates from a cell of said base station, it is the mobile communications channel switching method provided with a means which takes over a communication line while this mobile station is communicating to an adjoining base station without discontinuation.

[0011]Here a place by which it is characterized [of this invention] said means to perform, Including a means to perform channel switching according to said detection result and a channel-switch-control parameter, said mobile station, It has a means to perform channel switching according to a means to detect a communicating state and a movement state of a local station, and this detection result and channel-switch-control parameter of a means to detect, Said mobile station and said base station are located in a place provided with a means to calculate a preset value of said channel-switch-control parameter according to a detection result of each of said means to detect, respectively. As for said mobile station and said base station, it is desirable to have a means to exchange information about said channel-switch-control parameter mutually.

[0012]Said channel-switch-control parameter of said mobile station, A parameter calculated by a detection result of lapsed time from channel assignment a radio signal receiving level from a base station in the communication area where this mobile station exists, a position, movement speed, the move direction, and last time is included, Said channel-switch-control parameter of said base station, It is desirable to include a parameter calculated by a detection result of lapsed time from channel assignment a position of a radio signal receiving level from a mobile station which exists in a cell of this base station, and this mobile station, movement speed, the move direction, and last time.

[0013]As for a means to exchange for mutual [said], it is desirable to include a means performed whenever a preset value of said parameter exceeds variation defined beforehand.

[0014]The second viewpoint of this invention is a mobile station used for said mobile

communications channel switching method, and a place by which it is characterized [the]. It has a means to perform channel switching according to a means to detect a communicating state and a movement state of a local station, and this detection result and channel-switch-control parameter of a means to detect. It is in a place provided with a means to calculate a preset value of said channel-switch-control parameter according to a detection result of said means to detect, and a means to exchange information about said channel-switch-control parameter between said base stations.

[0015]

[Function]The receiving level of the base station in the movement speed of each mobile station, and a mobile station, the receiving level of the mobile station in a base station, A mobile station, or this mobile station and the base station under communication grasps the information on the lapsed time from a mobile station position, the mobile station move direction, and front channel assignment, and the channel-switch-control parameter set as a mobile station, and this mobile station and the base station under communication according to that state is changed.

[0016]Averaging time of a receiving level can be lengthened to a mobile station with slow movement speed, it can fluster by making the judging standard of channel switching implementation high, and the number of times can be lessened. Forced release can be lessened, when movement speed shortens averaging time to a quick mobile station and makes the judging standard of channel switching implementation low. When a receiving level is small, forced release can be lessened by shortening averaging time and making the judging standard of channel switching implementation low. When a receiving level is large, averaging time can be lengthened, it can fluster by making the judging standard of channel switching implementation high, and the number of times can be lessened. When cell shift is judged to be close by mobile station position information and move direction information, forced release can be lessened by making the judging standard of channel switching implementation low. When cell shift is judged not to be close, averaging time can be lengthened, it can fluster by making the judging standard of channel switching implementation high, and the number of times can be lessened.

[0017]The possibility of cell shift can be predicted to some extent also by the lapsed time after channel assignment. When the time after channel assignment is short, averaging time can be lengthened, it can fluster by making the judging standard of channel switching implementation high, and the number of times can be lessened.

[0018]Thereby, for every mobile station, a channel-switch-control parameter can be made into the optimal value, the rate of forced release at the time of channel switching is small, and quality channel switching to which the control load twisted for flustering becomes small can be performed.

[0019]

[Example]The composition of this invention example is explained with reference to drawing 1 thru/or drawing 3. Drawing 1 is an entire configuration figure of this invention example. Drawing 2 is a block lineblock diagram of a mobile station. Drawing 3 is a block lineblock diagram of a base station device.

[0020]This invention via a wireless circuit to the base stations 31, 32, and 33 and these base stations 31, 32, and 33 The connectable mobile stations 11 and 12, Have the exchange station 10 which controls the base stations 31, 32, and 33, and the base stations 31, 32, and 33 the communicating state and movement state of the mobile stations 11 and

12 which exist in the self-cells 21 and 22 and 23 The received signal level from the mobile stations 11 and 12, A means to detect from a fading pitch (the change cycle of a received signal level is said), and electric wave arrival directions, When the control section 65 is equipped with a means to perform channel switching according to the detection result of this means to detect and the mobile stations 11 and 12 deviate from the cell of the base stations 31, 32, and 33, It is the mobile communications channel switching method which equipped the control section 65 with the means which takes over a communication line while this mobile station 11 or 12 is communicating to the adjoining base stations 31, 32, and 33 without discontinuation.

[0021]Here the place by which it is characterized [of this invention] the control section 65 of the base stations 31, 32, and 33, Including a means to perform channel switching according to said detection result and a channel-switch-control parameter, the mobile stations 11 and 12, The communicating state and movement state of a local station as a means to detect The speed meter 42, GPS device 41, the counter 58, and the receiving level output line 44 of the receiver 54, The control section 59 is equipped with a means to perform channel switching according to this detection result and channel-switch-control parameter of a means to detect, The mobile stations 11 and 12 and the base stations 31, 32, and 33 are located in the place which considered it as a means to calculate the preset value of said channel-switch-control parameter according to the detection result of each of said means to detect, respectively, and was provided with the channel-switch-control parameter setting sections 57 and 64, respectively.

[0022]The control sections 59 and 65 of the mobile stations 11 and 12 and the base stations 31, 32, and 33 are provided with a means to exchange the information about said channel-switch-control parameter mutually via the baseband processing parts 55 and 63. In addition to detection by the received signal level from the mobile stations 11 and 12 used from the former mentioned above as a movement state detection means of the mobile stations 11 and 12 in the base stations 31, 32, and 33, a fading pitch, and electric wave arrival directions, the counter 66 is formed. This counter 66 is for acquiring the information on the lapsed time from channel assignment time last time.

[0023]The channel-switch-control parameter of the mobile stations 11 and 12, The parameter calculated by the detection result of the lapsed time from channel assignment the radio signal receiving level from the base stations 31, 32, and 33 of a cell where these mobile stations 11 and 12 exist, a position, movement speed, the move direction, and last time is included, The channel-switch-control parameter of the base stations 31, 32, and 33, The parameter calculated by the detection result of the lapsed time from channel assignment the position of the cells 21 and 22 of these base stations 31, 32, and 33, the radio signal receiving level from the mobile stations 11 and 12 which exist in 23, and these mobile stations 11 and 12, movement speed, the move direction, and last time is included.

[0024]A means to exchange the information about the channel-switch-control parameter of the control sections 59 and 65 mutually is performed whenever the preset value of a parameter exceeds the variation defined beforehand. . In the ** speed meter 42, in the mobile stations 11 and 12, speed becomes 0 m/s. **. The direction which the position measured with GPS device 41 measured with ** GPS device 41 which moves not less than 100 m changes 90 degrees or more. ** It performs for every above change point when the lapsed time from the front channel assignment measured with the counter 58

gets down from ** receiving level output line 44 which passes 10 seconds or more at, and a receiving level of not less than 20 dB changes.

[0025]. In the base stations 31, 32, and 33, the movement speed of the mobile stations 11 and 12 presumed by ** fading pitch becomes 0 m/s. **. The position of the mobile stations 11 and 12 measured from change of the response time to the state information signal demand sent out from the position information extracted from the state information signal sent out from the mobile stations 11 and 12 or the base stations 31, 32, and 33 moves not less than 100 m. **. The direction of the mobile stations 11 and 12 measured by the azimuth information extracted from the state information signal or the direction of a wave coming changes 90 degrees or more. ** The going-up receiving level from ** receiving level output line 72 in which the lapsed time from the front channel assignment measured with the counter 66 passes 10 seconds or more is performed for every above change point that changes not less than 20 dB.

[0026]Next, operation of this invention example is explained. In drawing 2, if channel assignment is performed, a reset signal will be taken out with the counter 58 of the mobile stations 11 and 12 from the control section 59, and the lapsed time after channel assignment will be counted at it. In the channel-switch-control parameter setting section 57. A receiving level obtains the receiver 54 and mobile station speed, and, in the speed meter 42 and a mobile station position, GPS device 41 and the lapsed time from channel assignment obtain a receiving level, mobile station speed, a mobile station position, and the mobile station state information of the lapsed time from channel assignment from the counter 58, respectively. The information on the receiving level in the base stations 31, 32, and 33 is sent out from the base stations 31, 32, and 33, is extracted from the baseband processing part 55 via the receiver 54, and is inputted into the channel-switch-control parameter setting section 57.

[0027]The above-mentioned state information acquired with the mobile stations 11 and 12 is inputted into the baseband processing part 55 from the channel-switch-control parameter setting section 57, and is sent out to the base stations 31, 32, and 33 via the transmitter 53.

[0028]The channel-switch-control parameter setting section 57 calculates the optimal parameter at present from such state information, and transmits it to the control section 59. This parameter is stored in the storage parts store 40, and processing of the control section 59 is performed according to the information stored in the storage parts store 40.

[0029]In drawing 3, if channel assignment is performed, a reset signal will be taken out with the counter 66 of the base stations 31, 32, and 33 from the control section 65, and the lapsed time after channel assignment will be counted at it. In the channel-switch-control parameter setting section 64. A receiving level, the lapsed time from front channel assignment, mobile station speed, The lapsed time from the strange demodulation section 62 and front channel assignment extracts the state information signal with which the counter 66, mobile station speed, and a position are sent out from the mobile stations 11 and 12 in the mobile station state information of a mobile station position, respectively from the baseband part 63, and a receiving level obtains it. Mobile station movement speed, a direction, and a position can be presumed by the fading pitch of this state information signal, arrival directions, and the response time of arrival from a state information signal demand. The channel-switch-control parameter setting section 64 calculates the optimal parameter at present from such state information, and transmits it

to the control section 65. This parameter is stored in the storage parts store 67, and processing of the control section 65 is performed according to the information stored in the storage parts store 67. Such state information is transmitted also to the mobile stations 11 and 12 via the baseband part 63.

[0030]The translation table is used for the parameter setting in the channel-switch-control parameter setting section 57 or 64. The translation table sets beforehand channel-switch-control parameters, such as a sample number for the reference value of communication quality, the reference value of a reception level difference, and equalization, as the average value. When it is necessary to change those parameters according to the state of the mobile stations 11 and 12, the value of a parameter is made to fluctuate according to a translation table. A translation table is shown in Table 3. Table 3 is a table showing a translation table.

[0031]

[Table 3]

移動局状態	チャンネル切替制御 パラメータ	通信品質の 基準値	受信レベル差 の基準値	平均化 サンプル数
移動局の 移動速度	30 km/h以上	±0	±0	-5
	1 km/h以下	±0	±0	+5
受信レベル	10 dB μ 以上	-1	+2	±0
	20 dB μ 以上	-2	+5	+1
移動局の位置	基地局から2 km以内	-2	+5	+1
	基地局から3 km以内	-1	+2	±0
移動方向	基地局から離れる	+1	-2	±0
	基地局に近づく	-1	+2	+1
チャンネル割当後の 経過時間	2秒以内	-2	+5	+1
	5秒以内	-1	+2	+0

In the example using this conversion parameter, although the variation of a parameter becomes rough, setting out of a fine parameter is attained by performing subdivision of a division, and conversion using expression in the case of a translation table.

[0032]Next, with reference to [drawing 4](#) and [drawing 5](#), operation of this invention example is explained further. [Drawing 4](#) is a flow chart which shows operation of the mobile stations 11 and 12. [Drawing 5](#) is a flow chart which shows operation of the base stations 31, 32, and 33. As shown in [drawing 4](#), when the mobile station 11 or 12 starts communication, a channel-switch-control parameter is set as the base stations 31 and 32 and the reference parameter reported for every 33, and is saved at the storage parts store 40 (S0). Continuously in the channel-switch-control parameter setting section 57. A mobile station state comes to hand from the receiver 54, 41 speed meter GPS device 42, and the baseband processing part 55 (S1). The existence of the necessity for parameter set value change is judged according to the state (S2), the parameter which will be changed into the control section 59 if change is required is sent, and a new parameter is saved at the storage parts store 40 (S3). The existence of the necessity for the report to the base

stations 31, 32, and 33 is judged using the mobile station information which came to hand, and (S4) and when required, it reports to the base stations 31, 32, and 33 via a wireless circuit (S5). Although the judging standard of a report is usually the same as that of preset value change, in order [to these base stations 31, 32, and 33] to prevent the increase in a control signal, it is also possible to make it lower than the judging standard of preset value change. Then, the usual channel-switch-control procedure is followed (S6). By repeating this the processing of a series of, channel switch control of the mobile stations 11 and 12 is performed.

[0033]As shown in drawing 5, when the base stations 31, 32, and 33 start the mobile station 11 or 12 and communication, a channel-switch-control parameter is set as the base stations 31 and 32 and the reference parameter beforehand set up for every 33, and is saved at the storage parts store 67 (S10). Continue and in the channel-switch-control parameter setting section 64. A mobile station state comes to hand from the strange demodulation section 62 and the baseband part 63 (S11), the existence of the necessity for parameter set value change is judged according to the state (S12), the parameter which will be changed into the control section 65 if change is required is sent, and a new parameter is saved at the storage parts store 67 (S13). The existence of the necessity for the report to the mobile station 11 or 12 is judged using the mobile station information which came to hand (S14), and when required, it reports to the mobile station 11 or 12 via a wireless circuit (S15). Although the judging standard of a report is usually the same as that of preset value change, in order [to this mobile station 11 or 12] to prevent the increase in a control signal, it can also be made lower than the judging standard of preset value change. Then, the usual channel-switch-control procedure is followed (S16). By repeating this the processing of a series of, channel switch control of the base stations 31, 32, and 33 is performed. The effect of this invention example is explained with reference to Table 4. Table 4 is a table showing the effect of this invention example acquired by computer simulation.

[0034]

[Table 4]

移動速度	1 m / s (低速時)		10 m / s (高速時)	
平均化時間	1.2 s	1.6 s	1.2 s	0.8 s
判定基準	8 dB	16 dB	8 dB	2 dB
ばたつき回数	22.0	3.71	0.36	3.91
強制切断率	0.014	0.019	0.28	0.13

As shown in Table 4, when a receiving level is small, forced release can be lessened by shortening averaging time and making the judging standard of channel switching implementation low. When a receiving level is large, averaging time can be lengthened, it can fluster by making the judging standard of channel switching implementation high, and the number of times can be lessened. When cell shift is judged to be close by mobile station position information and move direction information, forced release can be lessened by making the judging standard of channel switching implementation low. When cell shift is judged not to be close, averaging time can be lengthened, it can fluster

by making the judging standard of channel switching implementation high, and the number of times can be lessened.

[0035]

[Effect of the Invention]As explained above, according to this invention, the setting variation of the channel-switch-control parameter can be carried out to the optimal value at any time according to the state of each mobile station. Thereby, channel switching is performed properly and high communication of quality can be performed. Effective use of an electric wave can be aimed at.

[Translation done.]